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**Reg. No. :**

**Question Paper Code: 45032**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Fifth Semester

Electrical and Electronics Engineering

14UEE502 - CONTROL SYSTEMS

 (Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

 1. The principles of homogeneity and superposition are applied to

(a) Linear time variant systems (b) Non-linear time variant systems (c) Linear time invariant systems (d) Non-linear time invariant systems

 2. Transfer function of a system is used to calculate which of the following ?

 (a) The Order of the system (b) The Time constant

 (c) The output for any given input (d) The steady state gain

 3. The steady state error of a type 2 system with ramp input is

 (a) infinity (b) zero (c) 1 (d) -1

 4. The Transient Response, with feedback system ,

 (a) Rises slowly (b) Rises Quickly (c) Decays Slowly (d)Decays Quickly

 5. The Phase Margin of the system is 0*0*. It represents a

(a) Stable system (b) Unstable system (c) Conditionally stable system (d) Marginally stable system

6. Phase margin of a system is used to specify which of the following?

 (a) Frequency Response (b) Absolute stability

 (c) Relative stability (d) Time Response

7. A lead compensator

 (a) Improves the steady state accuracy (b) Reduces the bandwidth (c) Increases the bandwidth (d) Reduces the speed of response

8. The characteristic equation of a feedback control system is $s^{3}+Ks^{2}+5s+10$ = 0. For the system to be critically stable the value of ‘K’ should be

 (a) 1 (b) 2 (c) 3 (d) 4

9. The state transition matrix for the system $\dot{x}=Ax$with initial state x (0) is

(a) $(SI-A)^{-1}$ (b) $e^{At}x(0)$ (c) Laplace inverse of [ $(SI-A)^{-1}$ ] (d) Laplace inverse of $[\left(SI-A\right)^{-1}X(0)]$

10. State model representation is possible using \_\_\_\_\_\_\_\_\_

 (a) Physical variables (b) Phase variables

 (c) Canonical state variables (d) All of the above

 PART - B (5 x 2 = 10 Marks)

11. Define mathematical modeling of a dynamical system.

12. What are the transient and steady state response of a control system?

13. Define gain margin and phase margin.

14. Define absolute stability and relative stability.

15. State the properties of the state transition matrix.

PART - C (5 x 16 = 80 Marks)

16.(a) Find the equivalent transfer function for the system shown below using block

 diagram reduction technique. (16)



Or

 (b) Write the differential equations governing the Mechanical rotational system shown in

 figure. and find the transfer function. (16)



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17. (a) A positional control system with velocity feedback G(s) =  ,

 H(s)=Ks+1 . What is the response C(t) to the unit step input .Given that damping

 ratio = 0.5 . Also calculate rise time , Peak time , Maximum overshoot and

 settling time. (16)

 Or

 (b) Sketch the Root Locus of the control system whose forward path transfer function is . (16)

18. (a) Compare the properties of different phase compensators. Realize them using electrical network. (16)

 Or

 (b) Sketch the polar plot for the following transfer function .and find Gain cross over

 frequency, Phase cross over frequency, Gain margin and Phase margin.

 G(S) = 10/ S (1+0.2S) (1+0.002S) (16)

19. (a) Design a lead compensator for a unity feedback system with ,so that

 the static velocity error constant Kv is 20 sec-1,the phase margin is at least 50° and

 the gain margin is at least 10 dB. (16)

 Or

 (b) The open loop transfer function of an uncompensated system is $G\left(s\right)=\frac{K}{S\left(S+4\right)(S+80)}$

 Design a phase lag compensator to get a Phase margin of 33° and velocity error of

 Kv = 30 sec-1. (16)

20. (a) (i) Obtain the state space representation of this system in three canonical forms $T\left(s\right)=\frac{5(S+4)}{S^{3}+10S^{2}+31S+20}$. (8)

 (ii) Compute the state transition matrix *eAt* for the state model whose system matrix . (8)

Or

 (b) Determine whether the system described by the following state equation is

 completely state controllable and observable. (16)

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